



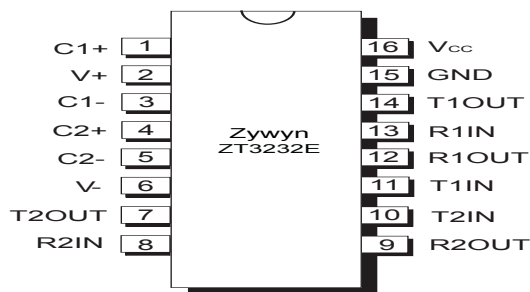
# ZT3220E, ZT3221E, ZT3222E, ZT3223E, ZT3232E, ZT1385E

## Low Power +3V to +5.5V, 250kbps RS232 Transceivers



### Features

- Meets EIA/TIA-232F and CCITT V.28/V.24 specifications for  $V_{CC}$  at  $+3.3V \pm 10\%$  and  $+5V \pm 10\%$
- Low Quiescent Current: 0.5mA typ., 1mA max.
- Low Shutdown Current (where applicable): 1 $\mu$ A typical, 10 $\mu$ A max.
- Guaranteed Data Rate 250kbps
- Proprietary Switch-Capacitor Regulated Voltage Converters (patent pending)
- Proprietary AUTOGREEN Power Saving (patent pending)
- Latch-up Free
- ESD Protection for RS-232 I/O's
  - $\pm 15kV$  Human Body Model (HBM)
  - $\pm 15kV$  EN61000-4-2 Air Gap Discharge
  - $\pm 8kV$  EN61000-4-2 Contact Discharge
- Drop-in Replacements for MAX3220E, SP3220E, MAX3221E, ICL3221E, MAX3222E, ICL3222E, SP3222E, MAX3223E, ICL3223E, SP3223E, MAX3232E, ICL3232E, SP3232E, LT1385, SP385E, IS3232E
- High Data Rate at 1000kbps Available on ZT32xxF Series



### General Description

The ZT32xxE series devices are 3V powered EIA/TIA-232 and V.28/V.24 communication interfaces with low power requirements. They consist of two line drivers, two line receivers and the proprietary switch-capacitor regulated voltage converters. The ZT3220E has a 1Tx and 1Rx configuration. These devices operate from a single 3V to 5.5V power supply at the guaranteed data rate of 250k bits/sec with enhanced electrostatic discharge (ESD) protection in all RS232 I/O pins exceeding  $\pm 15kV$  EN61000-4-2 Air Gap Discharge and  $\pm 8kV$  EN61000-4-2 Contact Discharge.

The ZT3221E and ZT3223E features the AUTOGREEN (patent pending) proprietary function which automatically powers down the on-chip regulated voltage converters and driver circuits when an RS-232 cable is disconnected from the host interface or when a connected peripheral device is turned off.

### Applications

- Battery-Powered And Hand-Held Applications
- Notebooks, Subnotebooks, and Palmtops
- Industrial and Embedded PCs
- Data Cables for Cell Phones and PDAs
- Terminal Adapters and POS terminals
- Peripherals interface
- Routers and HUBs

### Product Selection Guide

| Part Number | Power Supply | RS232 Drivers | RS232 Receivers | Data Rate (kbps) | 15KV ESD IEC1000 4-2 | Receiver Enable | SHUTDOWN Enable | AUTOGREEN Function | Number of Pins | Package Type                   |
|-------------|--------------|---------------|-----------------|------------------|----------------------|-----------------|-----------------|--------------------|----------------|--------------------------------|
| ZT3220E     | +3V to +5.5V | 1             | 1               | 250              | RS232 I/O            | YES             | YES             | NO                 | 16             | SSOP, TSSOP, WSOIC             |
| ZT3221E     | +3V to +5.5V | 1             | 1               | 250              | RS232 I/O            | YES             | YES             | YES                | 16             | SSOP, TSSOP                    |
| ZT3222E     | +3V to +5.5V | 2             | 2               | 250              | RS232 I/O            | YES             | YES             | NO                 | 18, 20         | 18-WSOIC, 20-SSOP, 20-TSSOP,   |
| ZT3232E     | +3V to +5.5V | 2             | 2               | 250              | RS232 I/O            | NO              | NO              | NO                 | 16             | NSOIC, WSOIC, SSOP, TSSOP, QFN |
| ZT3223E     | +3V to +5.5V | 2             | 2               | 250              | RS232 I/O            | YES             | YES             | YES                | 20             | SSOP, TSSOP                    |
| ZT1385E     | +3V to +5.5V | 2             | 2               | 250              | RS232 I/O            | NO              | YES             | NO                 | 18, 20         | 18-WSOIC, 20-SSOP              |



## Absolute Maximum Ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

|                                                                    |                              |
|--------------------------------------------------------------------|------------------------------|
| Power Supply, ( $V_{CC}$ ).....                                    | -0.3V to +6.0V               |
| $V+$ .....                                                         | -0.3V to +7.0V               |
| $V-$ .....                                                         | +0.3V to -7.0V               |
| $ V+  +  V- $ .....                                                | +13.0V                       |
| $I_{CC}$ (DC $V_{CC}$ or GND current).....                         | $\pm 100$ mA                 |
| Input Voltages                                                     |                              |
| $TxIN, \overline{GREEN}, \overline{SHUTDOWN}, \overline{EN}$ ..... | -0.3V to +6.0V               |
| $RxIN$ .....                                                       | $\pm 25$ V                   |
| Output Voltages                                                    |                              |
| $TxOUT$ .....                                                      | $\pm 15$ V                   |
| $RxOUT, \overline{IDLE}$ .....                                     | -0.3V to ( $V_{CC} + 0.3$ )V |
| Short-Circuit Duration                                             |                              |
| $TxOUT$ .....                                                      | Continuous                   |
| Operating Temperature.....                                         | -40°C to +85°C               |
| Storage Temperature.....                                           | -65°C to +150°C              |

### Power Dissipation Per Package

|                                                    |       |
|----------------------------------------------------|-------|
| 16-pin SSOP (derate 7.20mW/°C above +70°C)...      | 584mW |
| 16-pin nSOIC (derate 10.00mW/°C above +70°C)       | 720mW |
| 16-pin WSOIC (derate 10.10mW/°C above +70°C) ..... | 787mW |
| 16-pin TSSOP (derate 6.80mW/°C above +70°C)        | 556mW |
| 16-pin PDIP (derate 11.20mW/°C above +70°C) ..     | 896mW |
| 16-pin QFN (derate 24mW/°C above +70°C) .....      | 2W    |
| 18-pin PDIP (derate 12.60mW/°C above +70°C) ..     | 962mW |
| 18-pin WSOIC (derate 11.10mW/°C above +70°C)       | 850mW |

## Storage Considerations

Storage in a low humidity environment is preferred. Large high density plastic packages are moisture sensitive and should be stored in Dry Vapor Barrier Bags. Prior to usage, the parts should remain bagged and stored below 40°C and 60%RH. If the parts are removed from the bag, they should be used within 168 hours or stored in an environment at or below 20%RH. If the above conditions cannot be followed, the parts should be baked for 12 hours at 125°C in order to remove moisture prior to soldering. Zywyn ships product in Dry Vapor Barrier Bags with a humidity indicator card and desiccant pack. The humidity indicator should be below 30%RH. The MSL of this product is 3.

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## Electrical Characteristics

Unless otherwise stated,  $V_{CC} = +3.0V$  to  $+5.0V$ ,  $T_A = T_{min}$  to  $T_{max}$ ,  $C1$  to  $C4 = 0.1\mu F$ , typical values apply at  $V_{CC} = +3.3V$  or  $+5.0V$  and  $T_A = 25^\circ C$ .

| Parameter                                                                                                                                                    | Condition                                                                                                                                                                                                        | Min                         | Typ                           | Max                           | Units                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------|-------------------------------|-----------------------------------------------|
| TTL Logic Input<br>TTL Logic Output<br>RS-232 Input<br>RS-232 Output<br>Charge Pump Pin<br>Power Pin                                                         | $T_1IN, T_2IN, \overline{GREEN}, \overline{SHUTDOWN}, \overline{EN}$<br>$R_1OUT, R_2OUT, IDLE$<br>$R_1IN, R_2IN$<br>$T_1OUT, T_2OUT$<br>$C_1P, C_1N, C_2P, C_2N$<br>$V_{CC}, V_{GND}, V_{DD}, V_{SS}$            |                             |                               |                               |                                               |
| Charge Pump Caps<br>Temp $0^\circ C$ to $+70^\circ C$<br>Temp $-40^\circ C$ to $+85^\circ C$<br>$V_{CC}$ Voltage Range                                       | $C_1P, C_1N, C_2P, C_2N$<br>Commercial Grade<br>Industrial Grade<br>$V_{CC} = +5.0V$ Supply<br>$V_{CC} = +3.3V$ Supply                                                                                           | 0.1<br>0<br>-40<br>4.5<br>3 | 0.1<br>+25<br>+25<br>5<br>3.3 | 1<br>+70<br>+85<br>5.5<br>3.6 | $\mu F$<br>$^\circ C$<br>$^\circ C$<br>V<br>V |
| Supply Current                                                                                                                                               | TTL Inputs = $V_{CC}/GND$ , RS-232 Input = float,<br>$V_{CC} = 3.3V$ (For ZT3220E, ZT3222E, ZT3232E and ZT1385E)                                                                                                 |                             | 0.5                           | 1                             | mA                                            |
| Supply Current,<br>AUTOGREEN Disabled                                                                                                                        | $\overline{GREEN} = V_{CC}$ , (For ZT3221E and ZT3223E); $\overline{SHUTDOWN} = V_{CC}$ ,<br>(For ZT3221E, ZT3222E, ZT1385E and ZT3223E),<br>TTL Inputs = $V_{CC}/GND$ , RS-232 Input = float, $V_{CC} = 3.3V$   |                             | 0.5                           | 1                             | mA                                            |
| Supply Current,<br>AUTOGREEN Enabled                                                                                                                         | $\overline{GREEN} = GND$ , (For ZT3221E and ZT3223E); $\overline{SHUTDOWN} = V_{CC}$ ,<br>(For ZT3221E, ZT3222E, ZT1385E and ZT3223E),<br>TTL Inputs = $V_{CC}/GND$ , RS-232 Input = float, $V_{CC} = 3.3V$      |                             | 1                             | 10                            | $\mu A$                                       |
| Supply Current,<br>SHUTDOWN Enabled                                                                                                                          | $\overline{GREEN} = V_{CC}/GND$ , (For ZT3221E and ZT3223E);<br>$\overline{SHUTDOWN} = GND$ , (For ZT3221E, ZT3222E, ZT1385E and ZT3223E),<br>TTL Inputs = $V_{CC}/GND$ , RS-232 Inputs = float, $V_{CC} = 3.3V$ |                             | 1                             | 10                            | $\mu A$                                       |
| TTL LOGIC Input<br>Input Threshold Low<br>Input Threshold High<br>Input Threshold High<br>Input Hysteresis<br>Input Leakage Current<br>Input Leakage Current | $V_{CC} = +5.0V$ Supply<br>$V_{CC} = +3.3V$ Supply<br><br>$V_{IN} = V_{CC}$ and GND, $TIN, \overline{EN}, \overline{GREEN}, \overline{SHUTDOWN}$<br>$V_{IN} = V_{CC}$ and GND, $TIN$ (For ZT1385E)               | 2.4<br>2                    | 0.5<br>$\pm 0.01$<br>50       | 0.8<br><br>$\pm 1$<br>200     | V<br>V<br>V<br>V<br>$\mu A$<br>$\mu A$        |
| TTL LOGIC Output<br>Output Voltage Low<br>Output Voltage High<br>Output Leakage Current                                                                      | $I_{OUT} = 1.6mA$<br>$I_{OUT} = -1.0mA$<br>Receiver Outputs Disabled, $V_{OUT} = V_{CC}$ or GND,<br>$\overline{SHUTDOWN} = GND, EN = V_{CC}$                                                                     | $V_{CC}-0.6$                | $V_{CC}-0.1$<br>$\pm 0.05$    | 0.4<br>$\pm 10$               | V<br>V<br>$\mu A$                             |
| Receiver Input<br>Input Voltage Range<br>Input Threshold Low<br><br>Input Threshold High<br>Input Hysteresis<br>Input Resistance                             | $T_A = T_{min} - T_{max}$<br>$T_A = 25^\circ C, V_{CC} = 5.0V$<br>$T_A = 25^\circ C, V_{CC} = 3.3V$<br>$V = 25^\circ C$<br>$T_A = 25^\circ C$<br>$V_{IN} = \pm 25V, T_A = 25^\circ C$                            | -25<br>0.8<br>0.6<br><br>3  | 1.5<br>1.2<br><br>0.5         | 25<br><br>2.4<br>7            | V<br>V<br>V<br>V<br>k $\Omega$                |
| Transmitter Output<br>Output Voltage Swing<br>Output Resistance<br>Output Short-Circuit Current<br>Output Leakage Current                                    | $R_L = 3k\Omega$ , All Outputs are loaded<br>$V_{CC} = V_{DD} = V_{SS} = GND, V_{OUT} = \pm 2V$<br>$V_{OUT} = GND$<br>Transmitter Disabled, $V_{OUT} = \pm 12V$                                                  | $\pm 5$<br>300              | $\pm 5$                       | $\pm 60$                      | V<br>$\Omega$<br>mA<br>$\mu A$                |

| Parameter                                       | Condition                                                                                                                                 | Min | Typ      | Max | Units      |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|-----|------------|
| Timing Characteristics                          |                                                                                                                                           |     |          |     |            |
| Maximum Data Rate<br>Refers to Figure 1 and 2.  | $R_L = 3k\Omega$ , $C_L = 1000pF$ , One Transmitter Switching, $T_A = 25^\circ C$                                                         | 250 |          |     | kbps       |
| Transition-Region Slew Rate                     | $R_L = 3\sim 7k\Omega$ , $C_L = 150pF$ to $1000pF$ , One Transmitter Switching, $T_A = 25^\circ C$ , Measured from 3V to -3V or -3V to 3V | 6   |          | 30  | V/ $\mu s$ |
| Receiver Propagation $t_{PLH}$                  | $C_L = 150pF$                                                                                                                             |     | 0.15     |     | $\mu s$    |
| Receiver Propagation $t_{PHL}$                  | $C_L = 150pF$                                                                                                                             |     | 0.15     |     | $\mu s$    |
| Receiver Skew                                   | $t_{PHL} - t_{PLH}$                                                                                                                       |     | 50       |     | ns         |
| Receiver Output Enable Time                     | For ZT3220E, ZT3221E, ZT3222E, ZT3223E only                                                                                               |     | 0.2      |     | $\mu s$    |
| Receiver Output Disable Time                    | For ZT3220E, ZT3221E, ZT3222E, ZT3223E only                                                                                               |     | 0.2      |     | $\mu s$    |
| AUTOGREEN Timing                                |                                                                                                                                           |     |          |     |            |
| Receiver Input to $\overline{IDLE}$ Output High | For ZT3221E and ZT3223E only                                                                                                              |     | 1        |     | $\mu s$    |
| Receiver Input to $\overline{IDLE}$ Output Low  | For ZT3221E and ZT3223E only                                                                                                              |     | 30       |     | $\mu s$    |
| Power Save Mode<br>to Transmitter Enabled       | For ZT3221E and ZT3223E only                                                                                                              |     | 100      |     | $\mu s$    |
| ESD Tolerance                                   |                                                                                                                                           |     |          |     |            |
| ESD HBM                                         | RS-232 Inputs and Outputs                                                                                                                 |     | $\pm 15$ |     | kV         |
| EN61000-4-2 Contact Discharge                   | RS-232 Inputs and Outputs                                                                                                                 |     | $\pm 8$  |     | kV         |
| EN61000-4-2 Air Gap Discharge                   | RS-232 Inputs and Outputs                                                                                                                 |     | $\pm 15$ |     | kV         |

## Product Cross Reference

|             | Pin-to-Pin          | Pin-to-Pin          | Pin-to-Pin          | Pin-to-Pin        | Pin-to-Pin          |
|-------------|---------------------|---------------------|---------------------|-------------------|---------------------|
| Part Number | Cross MAXIM         | Cross Intersil      | Cross TI            | Cross ST-M        | Cross EXAR          |
| ZT3220E     | MAX3220E<br>MAX3220 | n/a                 | MAX3220E            | n/a               | SP3220E             |
| ZT3221E     | MAX3221E<br>MAX3221 | ICL3221E<br>ICL3221 | MAX3221E<br>MAX3221 | n/a               | n/a                 |
| ZT3222E     | MAX3222E<br>MAX3222 | ICL3222E<br>ICL3222 | MAX3222E<br>MAX3222 | ST3222E<br>ST3222 | SP3222E<br>SP3222EB |
| ZT3232E     | MAX3232E<br>MAX3232 | ICL3232E<br>ICL3232 | MAX3232E<br>MAX3232 | ST3232E<br>ST3232 | SP3232E<br>SP3232EB |
| ZT3223E     | MAX3223E<br>MAX3223 | ICL3223E<br>ICL3223 | MAX3223E<br>MAX3223 | n/a               | SP3223E<br>SP3223EB |
| ZT1385E     | n/a                 | n/a                 | LT1385              | n/a               | SP385E              |

## Pin Description

| Pin Numbers |         |         |         |          |         |           |         | Name                   | Description                                                                                                         |
|-------------|---------|---------|---------|----------|---------|-----------|---------|------------------------|---------------------------------------------------------------------------------------------------------------------|
| ZT3220E     | ZT3221E | ZT3222E |         | ZT3232E  | ZT1385E |           | ZT3223E |                        |                                                                                                                     |
| 16 Pins     | 16 Pins | 18 Pins | 20 Pins | 16 Pins* | 18 Pins | 20 Pins   | 20 Pins |                        |                                                                                                                     |
| 1           | 1       | 1       | 1       | –        | –       | –         | 1       | $\overline{\text{EN}}$ | Receiver Enable. Logic low for Normal operation. Logic high to force the receiver outputs into high impedance state |
| 2           | 2       | 2       | 2       | 1        | 2       | 2         | 2       | C1+                    | Positive terminal of the bootstrapped voltage switch capacitor                                                      |
| 3           | 3       | 3       | 3       | 2        | 3       | 3         | 3       | V+                     | Regulated +5.4V output generated by the voltage converter                                                           |
| 4           | 4       | 4       | 4       | 3        | 4       | 4         | 4       | C1-                    | Negative terminal of the bootstrapped voltage switch capacitor                                                      |
| 5           | 5       | 5       | 5       | 4        | 5       | 5         | 5       | C2+                    | Positive terminal of the inverted voltage switch capacitor                                                          |
| 7           | 7       | 7       | 7       | 6        | 7       | 7         | 7       | V-                     | Regulated –5.7V output generated by the voltage converter                                                           |
| 6           | 6       | 6       | 6       | 5        | 6       | 6         | 6       | C2-                    | Negative terminal of the inverted voltage switch capacitor                                                          |
| 8           | 8       | 14      | 16      | 13       | 14      | 16        | 16      | R1 IN                  | First RS232 receiver input                                                                                          |
| –           | –       | 9       | 9       | 8        | 9       | 9         | 9       | R2 IN                  | Second RS232 receiver input                                                                                         |
| 9           | 9       | 13      | 15      | 12       | 13      | 15        | 15      | R1 OUT                 | First TTL/CMOS receiver output                                                                                      |
| –           | –       | 10      | 10      | 9        | 10      | 12        | 10      | R2 OUT                 | Second TTL/CMOS receiver output                                                                                     |
| 11          | 11      | 12      | 13      | 11       | 12      | 14        | 13      | T1 IN                  | First TTL/CMOS transmitter input                                                                                    |
| –           | –       | 11      | 12      | 10       | 11      | 13        | 12      | T2 IN                  | Second TTL/CMOS transmitter input                                                                                   |
| 13          | 13      | 15      | 17      | 14       | 15      | 17        | 17      | T1 OUT                 | First RS232 transmitter output                                                                                      |
| –           | –       | 8       | 8       | 7        | 8       | 8         | 8       | T2 OUT                 | Second RS232 transmitter output                                                                                     |
| –           | 10      | –       | –       | –        | –       | –         | 11      | IDLE                   | TTL/CMOS output indicating AUTOGREEN or SHUTDOWN status                                                             |
| 16          | 16      | 18      | 20      | –        | 18      | 20        | 20      | SHUTDOWN               | Shutdown control. A logic LOW to disable drivers and voltage converter                                              |
| –           | 12      | –       | –       | –        | –       | –         | 14      | GREEN                  | A logic HIGH to override AUTO-GREEN circuitry keeping transmitters ON. (SHUTDOWN must be HIGH)                      |
| 14          | 14      | 16      | 18      | 15       | 16      | 18        | 18      | GND                    | Ground                                                                                                              |
| 15          | 15      | 17      | 19      | 16       | 17      | 19        | 19      | V <sub>CC</sub>        | +3V to +5.5V Supply Voltage                                                                                         |
| 10, 12      | –       | –       | 11, 14  | –        | 1       | 1, 10, 11 | –       | NC                     | No connect                                                                                                          |

\*Pin-outs for NSOIC, WSOIC, SSOP and TSSOP packages only.

**Pin Description**

ZT3232LEEQ (5x5 16-QFN Package)

| Pin Number | Pin Name | Pin Function                                                     |
|------------|----------|------------------------------------------------------------------|
| 1          | C1-      | Negative terminal of the bootstrapped voltage switch capacitor   |
| 2          | C2+      | Positive terminal of the inverted voltage switch capacitor       |
| 3          | C2-      | Negative terminal of the bootstrapped voltage switch capacitor . |
| 4          | V-       | Regulated -5.7V output generated by the voltage converter        |
| 5          | T2OUT    | Second RS232 transmitter output                                  |
| 6          | R2IN     | Second RS232 receiver input.                                     |
| 7          | R2OUT    | Second TTL/CMOS receiver output.                                 |
| 8          | T2IN     | Second TTL/CMOS transmitter input.                               |
| 9          | T1IN     | First TTL/CMOS transmitter input                                 |
| 10         | R1OUT    | First TTL/CMOS receiver output.                                  |
| 11         | R1IN     | First RS232 receiver input.                                      |
| 12         | T1OUT    | First RS232 transmitter output                                   |
| 13         | GND      | Ground.                                                          |
| 14         | VCC      | +3V to +5.5V Supply Voltage                                      |
| 15         | C1+      | Positive terminal of the bootstrapped voltage switch capacitor   |
| 16         | V+       | Regulated +5.4V output generated by the voltage onverter         |

## Circuit Description

### Proprietary Switch-Capacitor Regulated Voltage Converter

Different from other suppliers, Zywyn uses a patent pending switch-capacitor voltage-controlled source and sink current generators design to provide powerful bipolar voltages to maintain compliant EIA/RS232 levels regardless of power supply fluctuations. The design consists of an internal regulated oscillator, a two phase clock cycling, regulated complementary MOS switches, fast switching diode and switch capacitors.

The switch capacitor bi-directional current generators operate with Zywyn's proprietary smartly regulated complementary MOS switches and fast switching diode from its proprietary high voltage process technology. The efficiency of these bi-directional current generators is well over 70%. The switching frequency is generated by an internal oscillator and regulated by the current loads. The switch capacitor pump design delivers higher negative bucked voltage than the positive boosted voltage to achieve a balanced voltage controlled source and sink current generators resulting a balanced bipolar voltage supplies to the chip.

With its unique proprietary design technique, Zywyn's interface product series provide a better power efficient, stable and compliant EIA/RS232 levels with superior low power consumption.

### Controlled Power-Down

The ZT3220E, ZT3221E, ZT3222E, and ZT3223E have a low-power shutdown mode controlled by the SHUTDOWN pin. During shutdown the driver output and the switch-capacitor regulated voltage converter are disabled with the supply current falls to less than 1 $\mu$ A.

The ZT3221E and ZT3223E use Zywyn's patent pending AUTOGREEN circuitry to set/reset latches, which enable the circuit shutdown function when a RS232 cable is disconnected or when the peripheral is turned off and reduce the power supply drain to a 1 $\mu$ A supply current. When a RS232 cable is connected or when the peripheral is enabled, the devices will automatically become active again.

### ESD Immunity

Electro-Static Discharge (ESD) is an important factor when implementing a serial port into a system. In some applications, it is crucial that the ESD protection for the system must meet a certain tolerance level. Since RS232 transceiver devices are exposed to the outside world, there are many environmental factors that can effect the serial port and even subject it to transients that could potentially damage the transceiver itself.

The RS232 transceiver is usually routed from the serial port connector to the transceiver IC through the metal trace on the printed circuit board. This trace will have some small amount of resistance that will add some protection in terms

of limiting transient current to the IC. However for added voltage protection, transient voltage suppressors (TVS) or transzorbs, which are back-to-back diode arrays clamp, are usually necessary to protect the serial port circuitry.

To further reduce cost within their system, more engineers are requiring higher ESD tolerances from the transceiver ICs themselves without having to add costly TVS circuitry. Zywyn's RS232 transceivers includes built-in transient voltage suppression where external ESD circuitry is not necessary to meet the MIL-STD-883, Method 3015, Human Body Model and the EN61000-4-2 Air/Contact Discharge tests.

The Human Body Model has been the generally accepted ESD testing method for semiconductors. This test is intended to simulate the human body's potential to store electrostatic energy and discharge it to an integrated circuit upon close proximity or contact. This method will test the IC's capability to withstand an ESD transient during normal handling such as in manufacturing areas where the ICs tend to be handled frequently.

EN61000-4-2 is used for testing ESD on equipment and systems. For system manufacturers, they must guarantee a certain amount of ESD protection since the system itself is exposed to the outside environment and human presence. EN61000-4-2 specifies that the system is required to withstand an amount of static electricity when ESD is applied to exposed metal points and surfaces of the equipment that are accessible to personnel during normal usage. The transceiver IC receives most of the ESD current when the ESD source is applied to the connector pins.

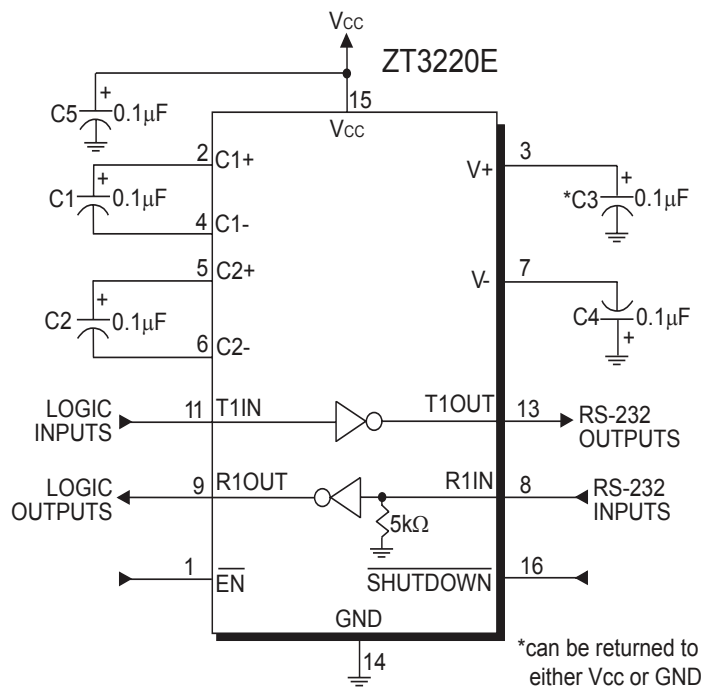
There are two methods within EN61000-4-2, the Air Discharge method and the Contact Discharge method. With the Air Discharge Method, an ESD voltage is applied to the equipment under test through air, which simulates an electrically charged person ready to connect a cable onto the rear of the system and the high energy potential on the person discharges through an arcing path to the rear panel of the system before he or she even touches the system. The Contact Discharge Method applies the ESD current directly to the EUT. This method was devised to reduce the unpredictability of the ESD arc. The discharge current rise time is constant since the energy is directly transferred without the air-gap arc inconsistencies.

Zywyn's RS232 transceivers meets and exceeds the minimum criteria for EN61000-4-2 with  $\pm 15$ kV for Air Gap Discharge and  $\pm 8$ kV for Contact Discharge.

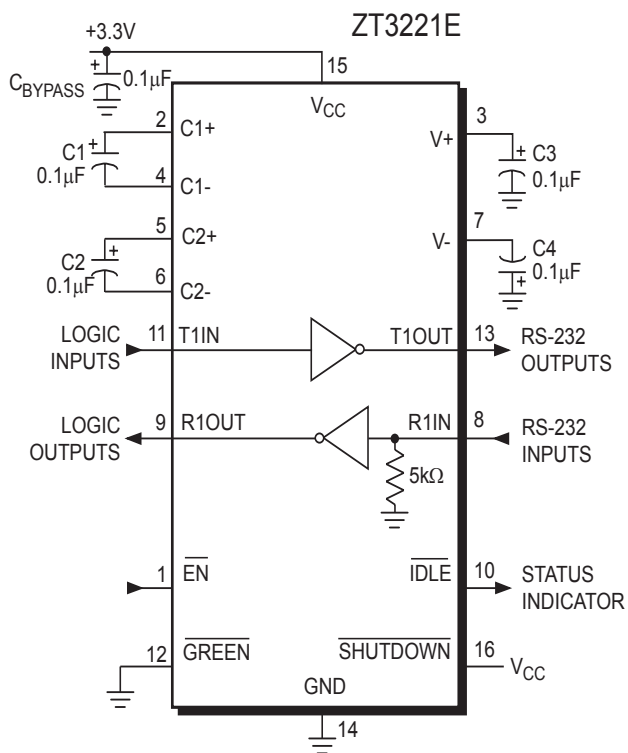
| Operation Status                         | $\overline{\text{GREEN}}$ | $\overline{\text{SHUTDOWN}}$ | $\overline{\text{EN}}$ | Signal at $\text{R}_\text{XIN}$ | $\overline{\text{IDLE}}$ | $\text{T}_\text{XOUT}$ | $\text{R}_\text{XOUT}$ |
|------------------------------------------|---------------------------|------------------------------|------------------------|---------------------------------|--------------------------|------------------------|------------------------|
| Shutdown                                 | don't care                | 0                            | 0                      | present                         | 1                        | tri-state              | active                 |
|                                          | don't care                | 0                            | 0                      | not present                     | 0                        | tri-state              | active                 |
|                                          | don't' care               | 0                            | 1                      | present                         | 1                        | tri-state              | tri-state              |
|                                          | don't' care               | 0                            | 1                      | not present                     | 0                        | tri-state              | tri-state              |
| Normal without $\overline{\text{GREEN}}$ | 1                         | 1                            | 0                      | present                         | 1                        | active                 | active                 |
|                                          | 1                         | 1                            | 0                      | not present                     | 0                        | active                 | active                 |
|                                          | 1                         | 1                            | 1                      | present                         | 1                        | active                 | tri-state              |
|                                          | 1                         | 1                            | 1                      | not present                     | 0                        | active                 | tri-state              |
| Normal with $\overline{\text{GREEN}}$    | 0                         | 1                            | 0                      | present                         | 1                        | active                 | active                 |
|                                          | 0                         | 1                            | 0                      | not present                     | 0                        | tri-state              | tri-state              |
|                                          | 0                         | 1                            | 1                      | present                         | 1                        | active                 | tri-state              |
|                                          | 0                         | 1                            | 1                      | not present                     | 0                        | tri-state              | tri-state              |

Table 1. ZT32xxE Truth Table

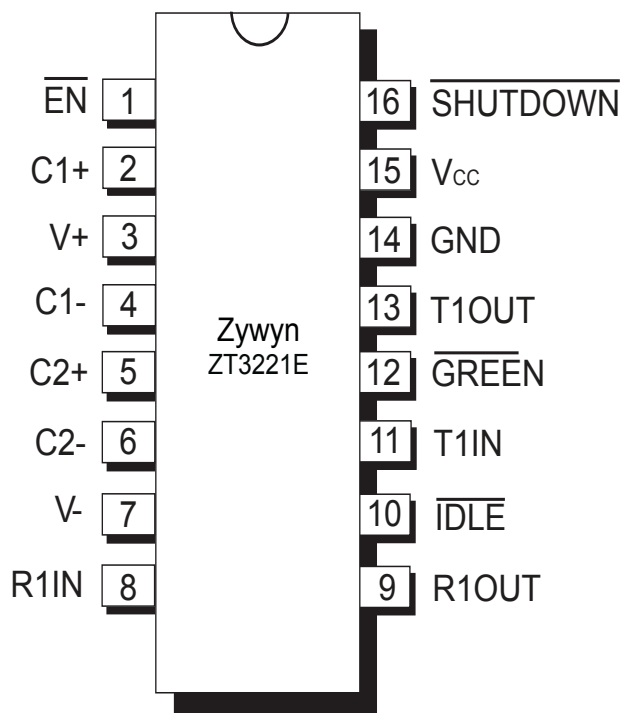
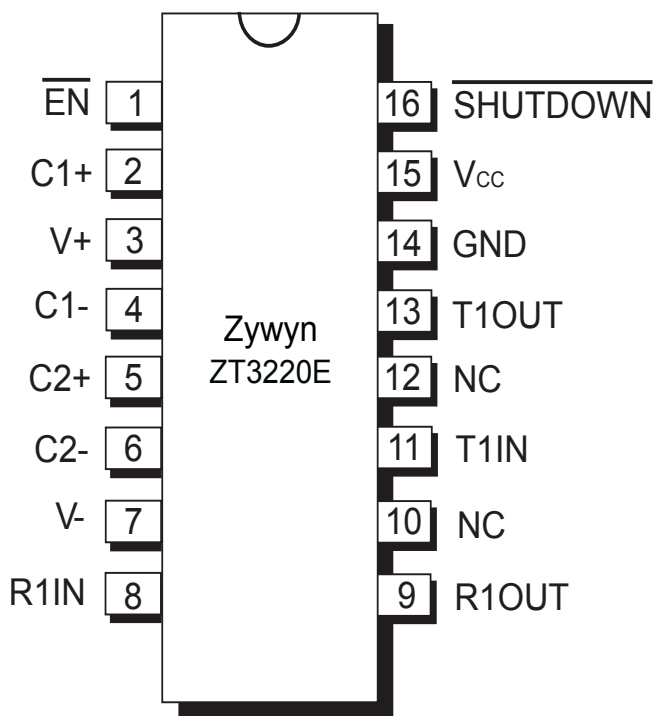
# Typical Application Circuits and Pin Configuration



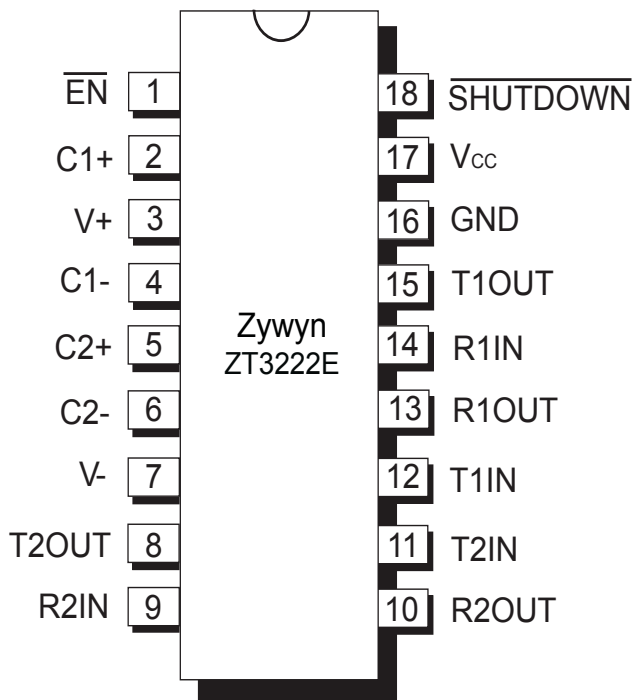
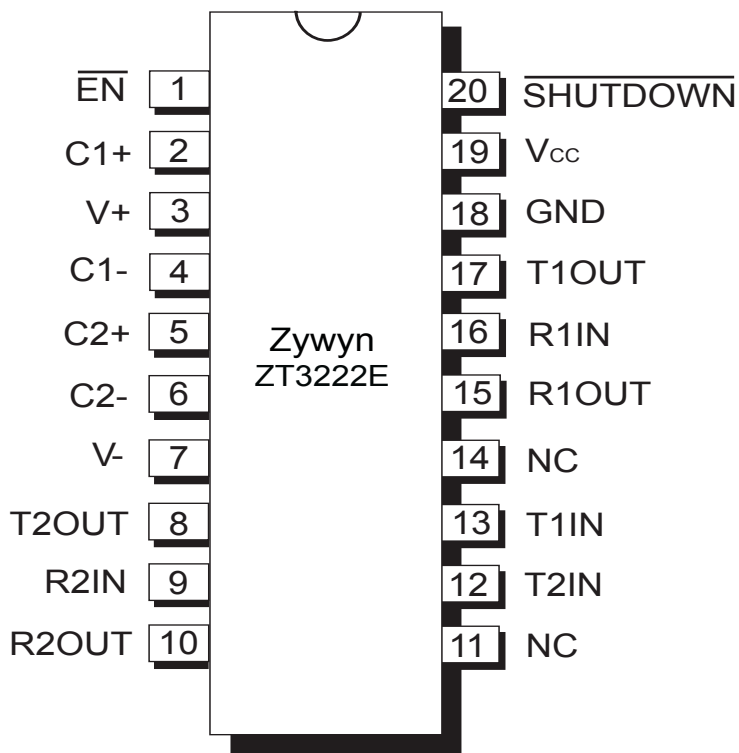
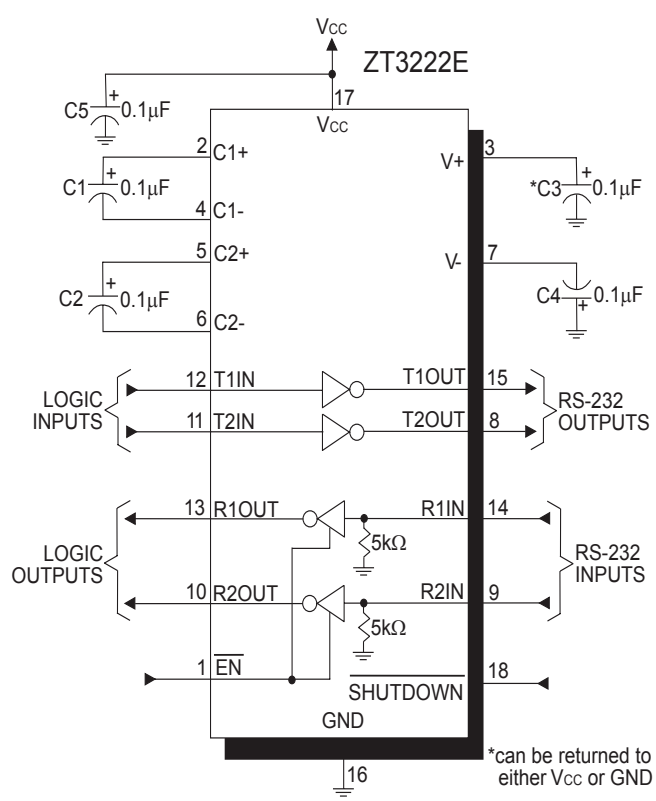
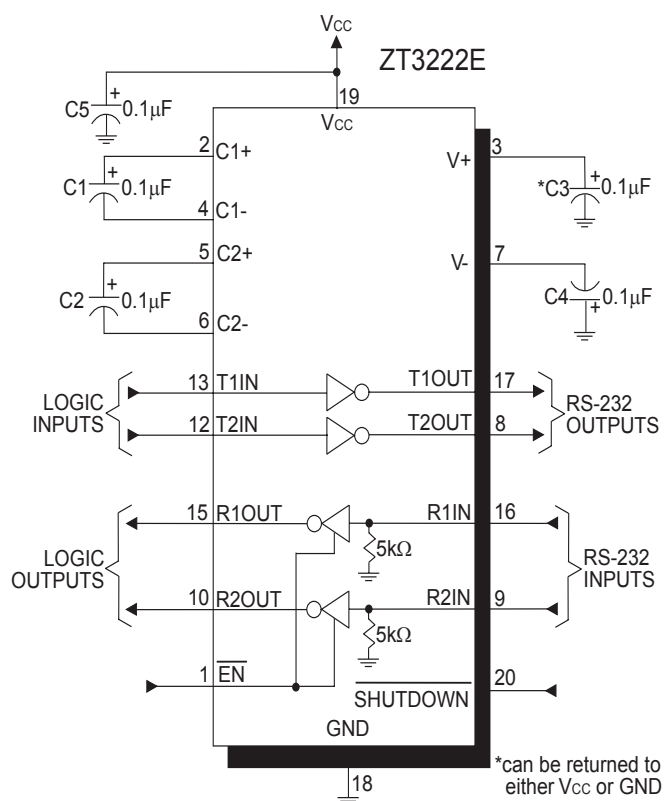
16-pin SSOP/TSSOP/WSOIC



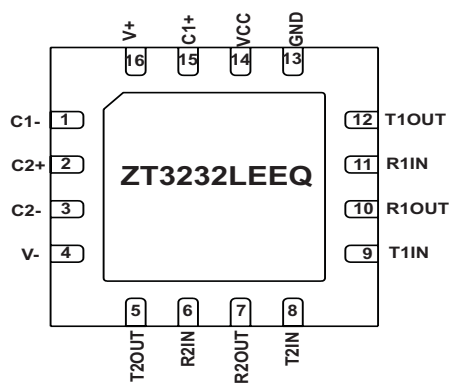
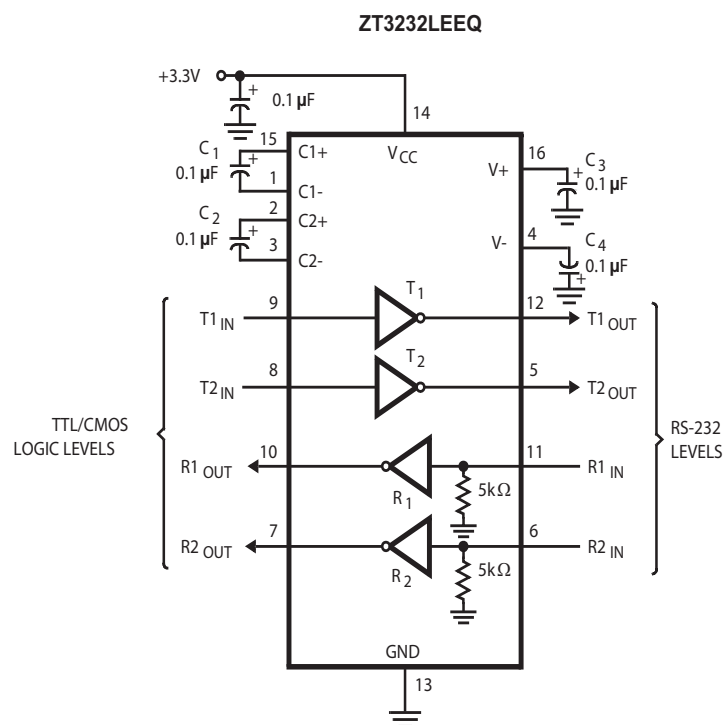
16-pin SSOP/TSSOP



## Typical Application Circuits and Pin Configuration

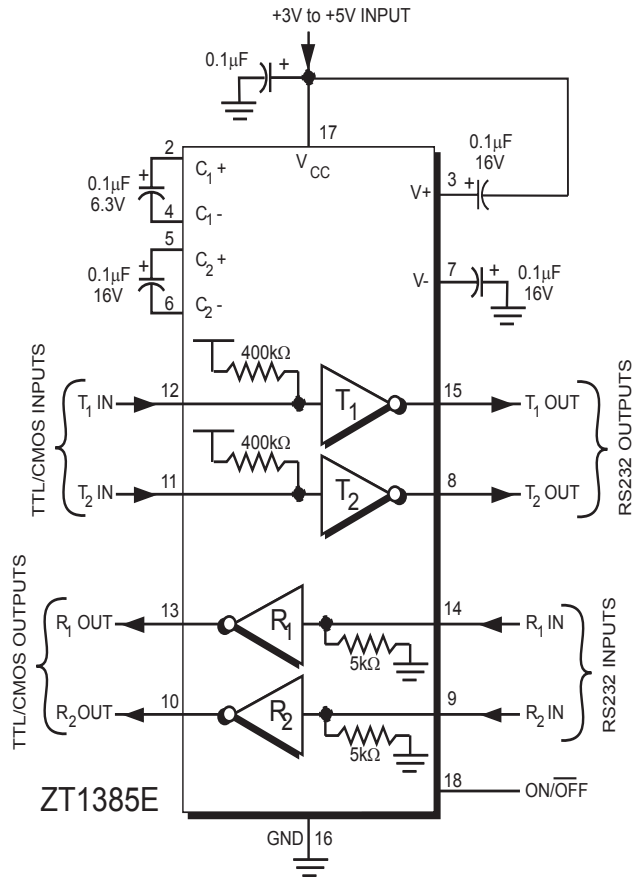


## Typical Application Circuits and Pin Configuration

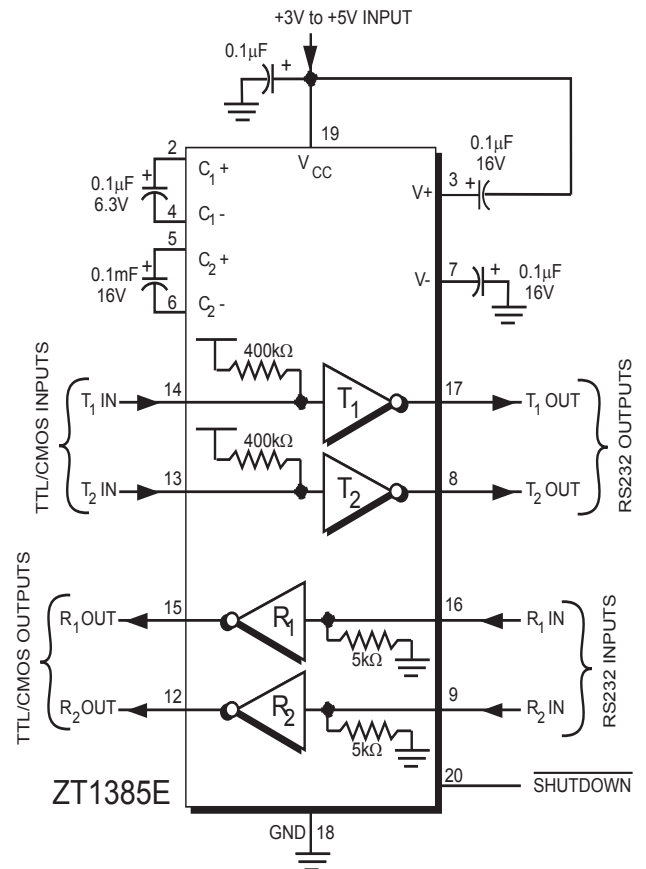




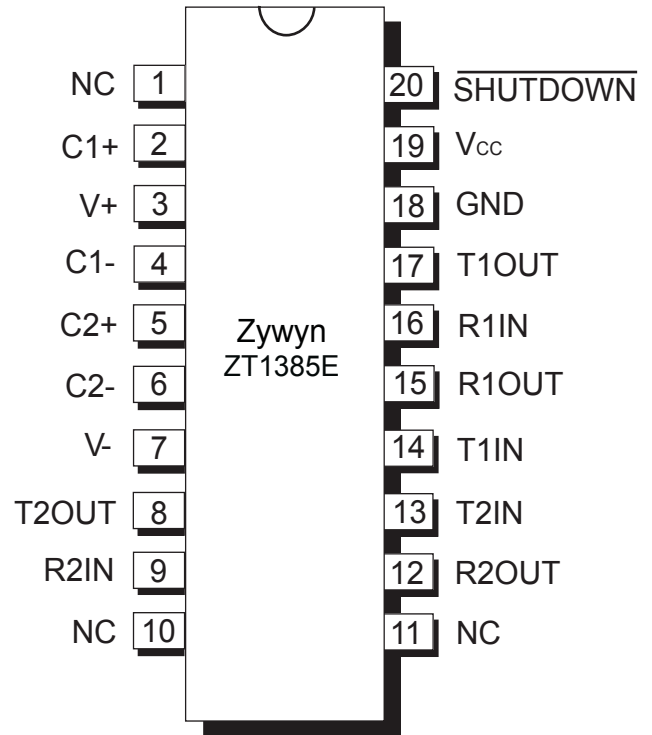
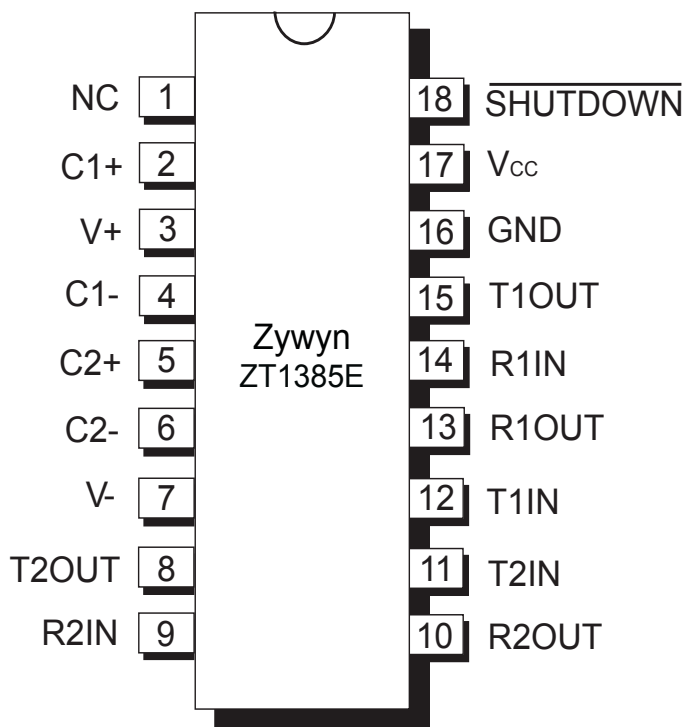
# Typical Application Circuits and Pin Configuration



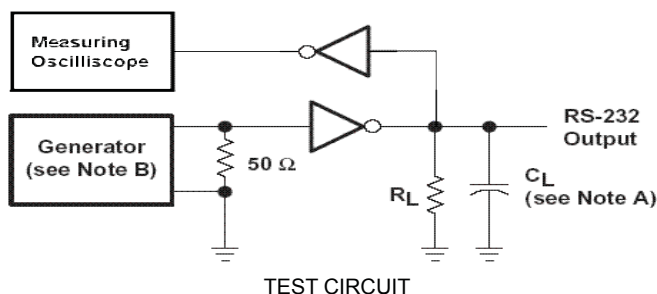
**18-pin WSOIC**



**20-pin SSOP**



## Typical Test Circuits



### Maximum Data Rate Test Circuit

Notes:

A.  $R_L = 3k\Omega$ ,  $C_L = 1000pF$ ,  $T_A = 25^\circ C$ ,

One Driver Switching.

B. The pulse generator had the following characteristics:

PRR = 250 kbps,  $Z_o = 50\Omega$ , 50% duty cycle,

$T_r$  &  $T_f \leq 10ns$ .

C.  $SHUTDOWN = V_{CC}$  when applicable.

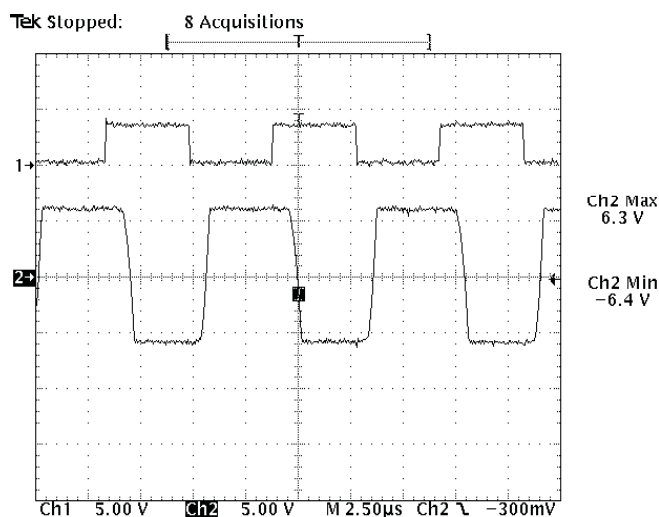


Figure 1. ZT32xxE TxIN to TxOut (no load) at 250kbps waveform

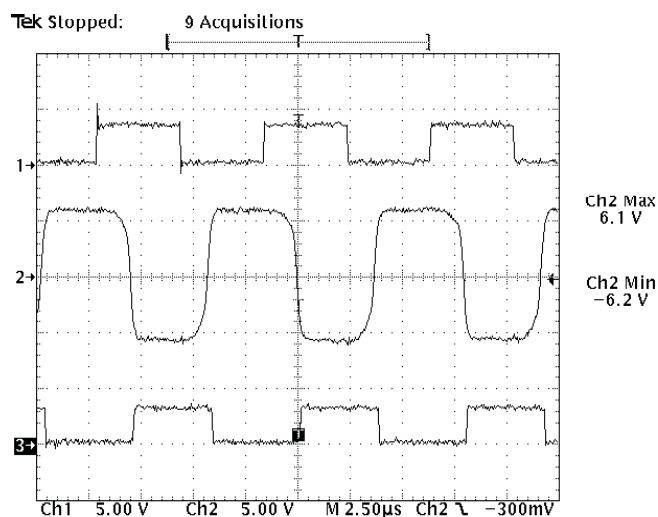


Figure 2. ZT32xxE TxIN to TxOut to RxOut (loopback to Rx with 1000pF load) at 250kbps waveform

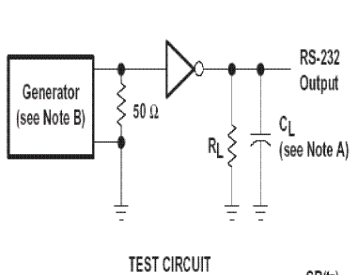
### RS232 Signal Characteristics

Figure 1 shows the normal RS232 transceiver function with a TTL/CMOS signal applied to the input on channel 1 and the resultant RS232 output shown on channel 2. This figure shows a typical RS232 line driver output without loading. In other words, this is the open circuit RS232 output voltage. The charge pump voltage converter efficiently converts the necessary voltage for the driver's output transistors so that the RS232 output is close to the ideal rail voltage of 6.6V.

Figure 2 shows the RS232 transceiver function using the TTL/CMOS input on channel 1 while showing the RS232 output on channel 2. This figure shows the RS232 signal while the output is loaded with 3kohms and 1000pF. The resistive load is the receiver's input impedance as the driver's output is looped back to the

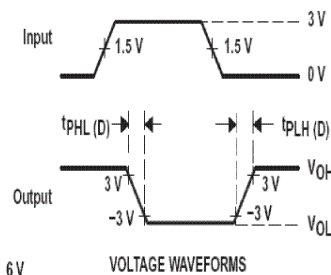
receiver's input. The resultant output on channel 3 is the receiver's TTL/CMOS output. While loaded with a typical RS232 load, the driver's output level only drops 0.2V from its open circuit voltage while running at 250kbps. The RS-232 output on channel 2 also shows good signal integrity while at the high data rates, which allows the receiver to process the signal with minimum skew and delay. Zywyn's low-drop driver circuitry working with its efficient voltage regulator allows superior line driving capability with the bonus of  $\pm 15kV$  ESD immunity.

## Typical Test Circuits



TEST CIRCUIT

$$SR(tr) = \frac{6V}{t_{PHL(D)} \text{ or } t_{PLH(D)}}$$



VOLTAGE WAVEFORMS

### Driver Transition-Region Slew Rate Test Circuit

Notes:

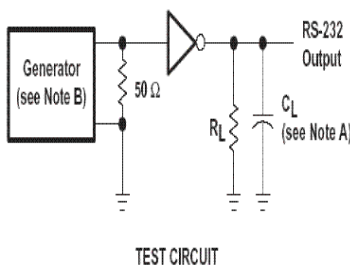
A.  $R_L = 3k \sim 7k\Omega$ ,  $C_L = 150pF$  to  $1000pF$ ,  
One Driver Switching,  $T_A = 25^\circ C$ ,  
Measured from  $+3V$  to  $-3V$  or  $-3V$  to  $+3V$ .

B. The pulse generator had the following characteristics:

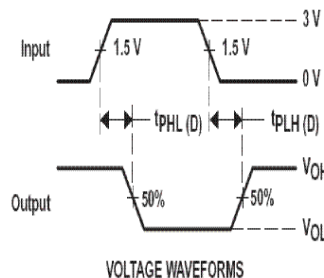
PRR = 250 kbps,  $Z_o = 50\Omega$ , 50% duty cycle,

$T_r$  &  $T_f \leq 10ns$ .

C. SHUTDOWN =  $V_{CC}$  when applicable.



TEST CIRCUIT



VOLTAGE WAVEFORMS

### Driver Propagation ( $t_{PHL}$ & $t_{PLH}$ ) Test Circuit

Notes:

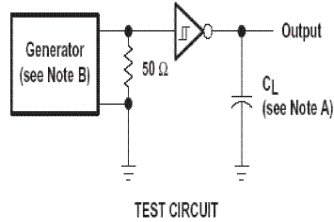
A. All drivers loaded with  $R_L = 3k\Omega$ ,  $C_L = 1000pF$ .

B. The pulse generator had the following characteristics:

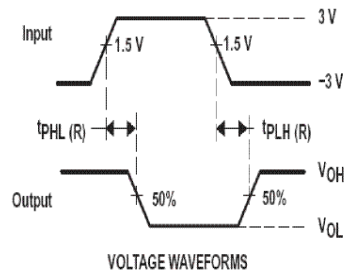
PRR = 250 kbps,  $Z_o = 50\Omega$ , 50% duty cycle,

$T_r$  &  $T_f \leq 10ns$ .

C. SHUTDOWN =  $V_{CC}$  when applicable.



TEST CIRCUIT



VOLTAGE WAVEFORMS

### Receiver Propagation Delay Times Test Circuit

Notes:

A.  $C_L = 150pF$ , including probe and jig capacitance.

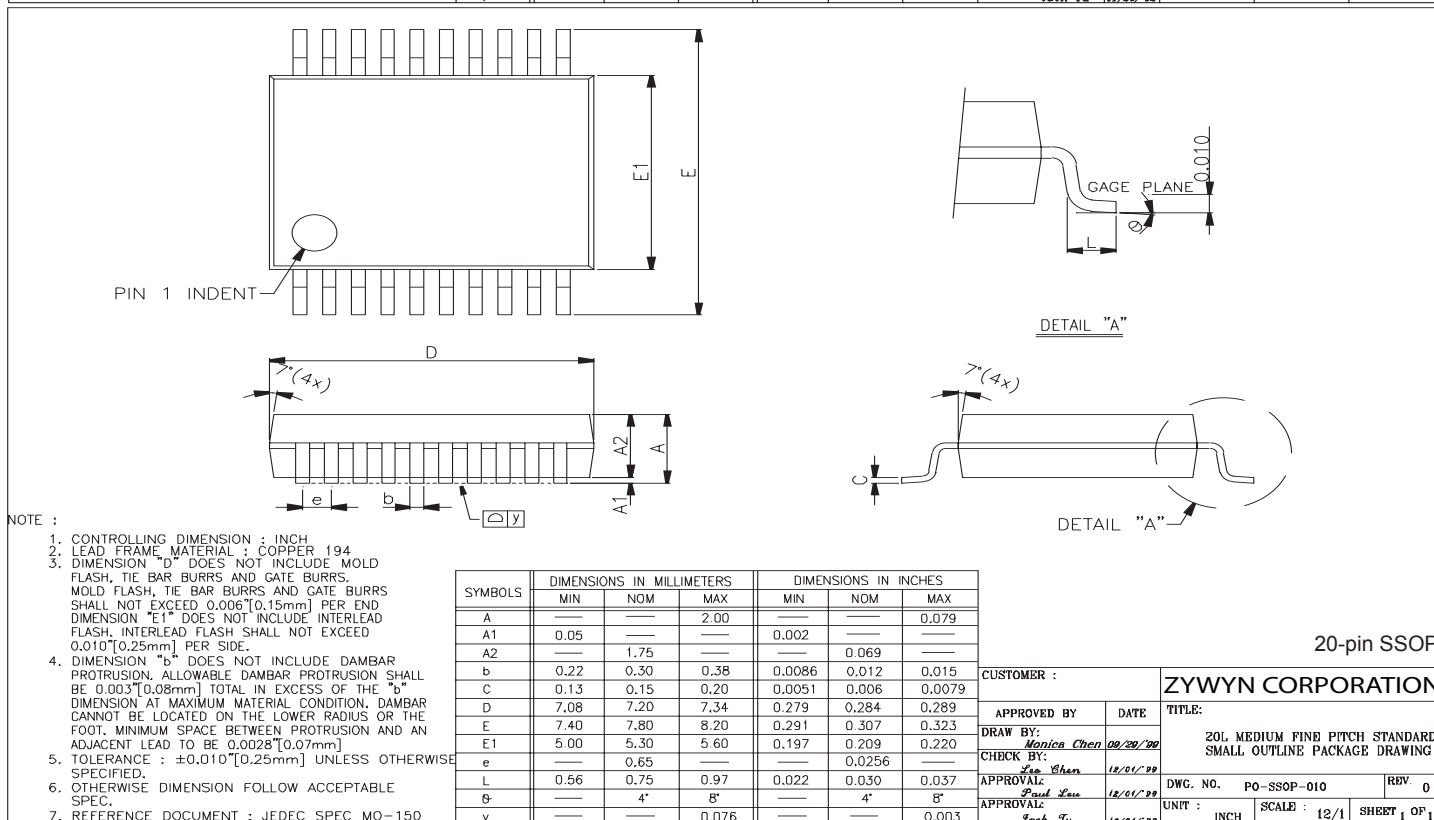
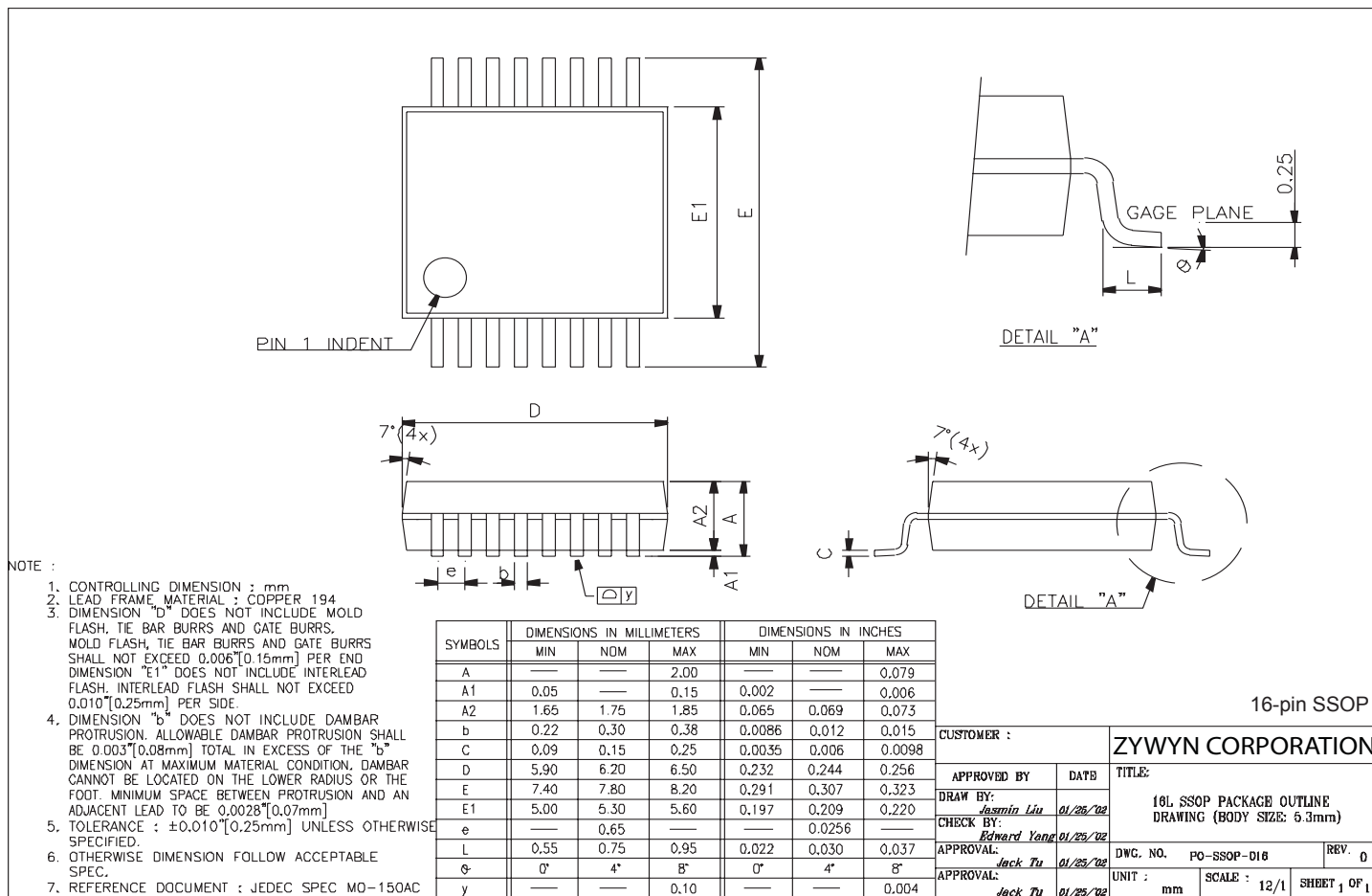
B. The pulse generator had the following characteristics:

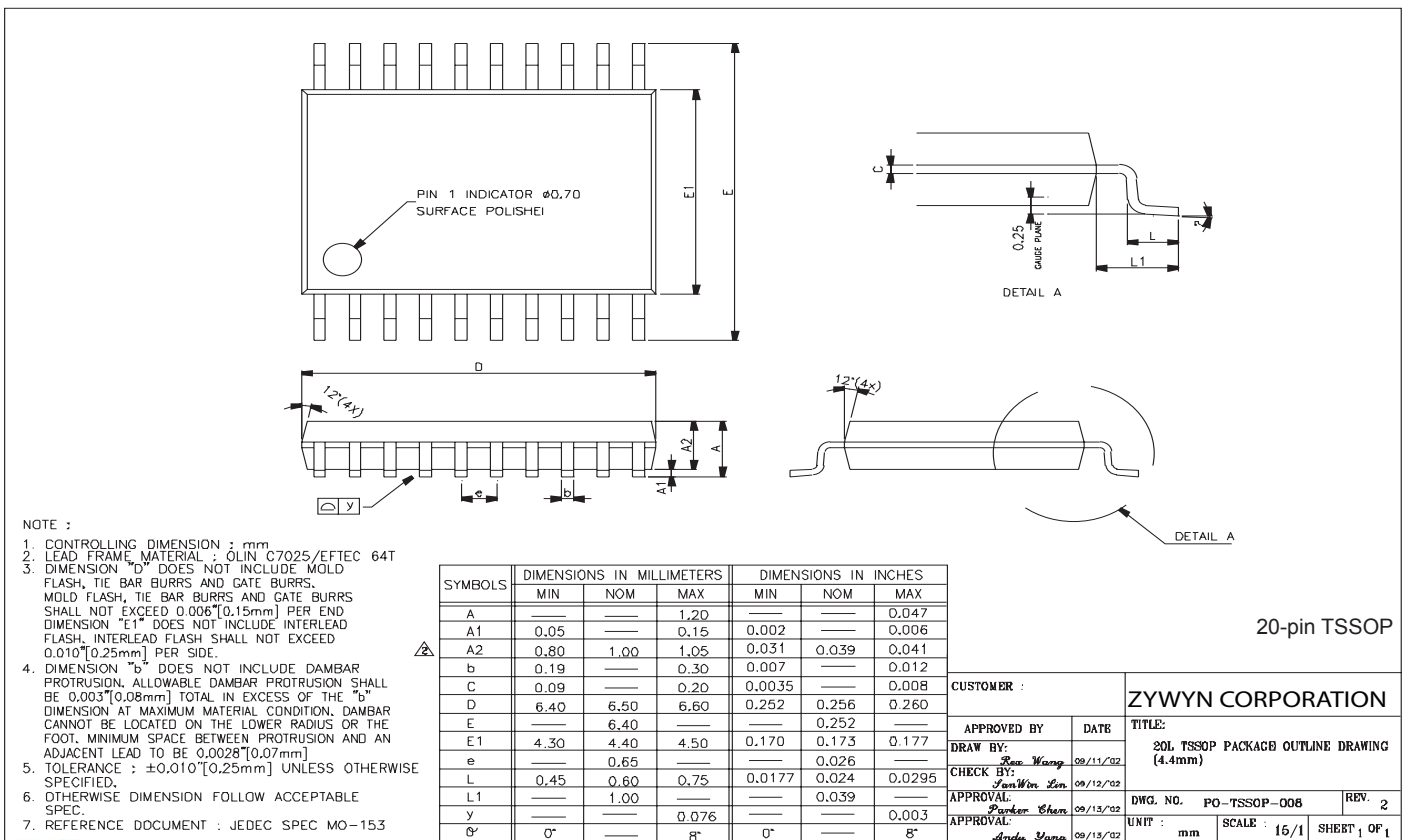
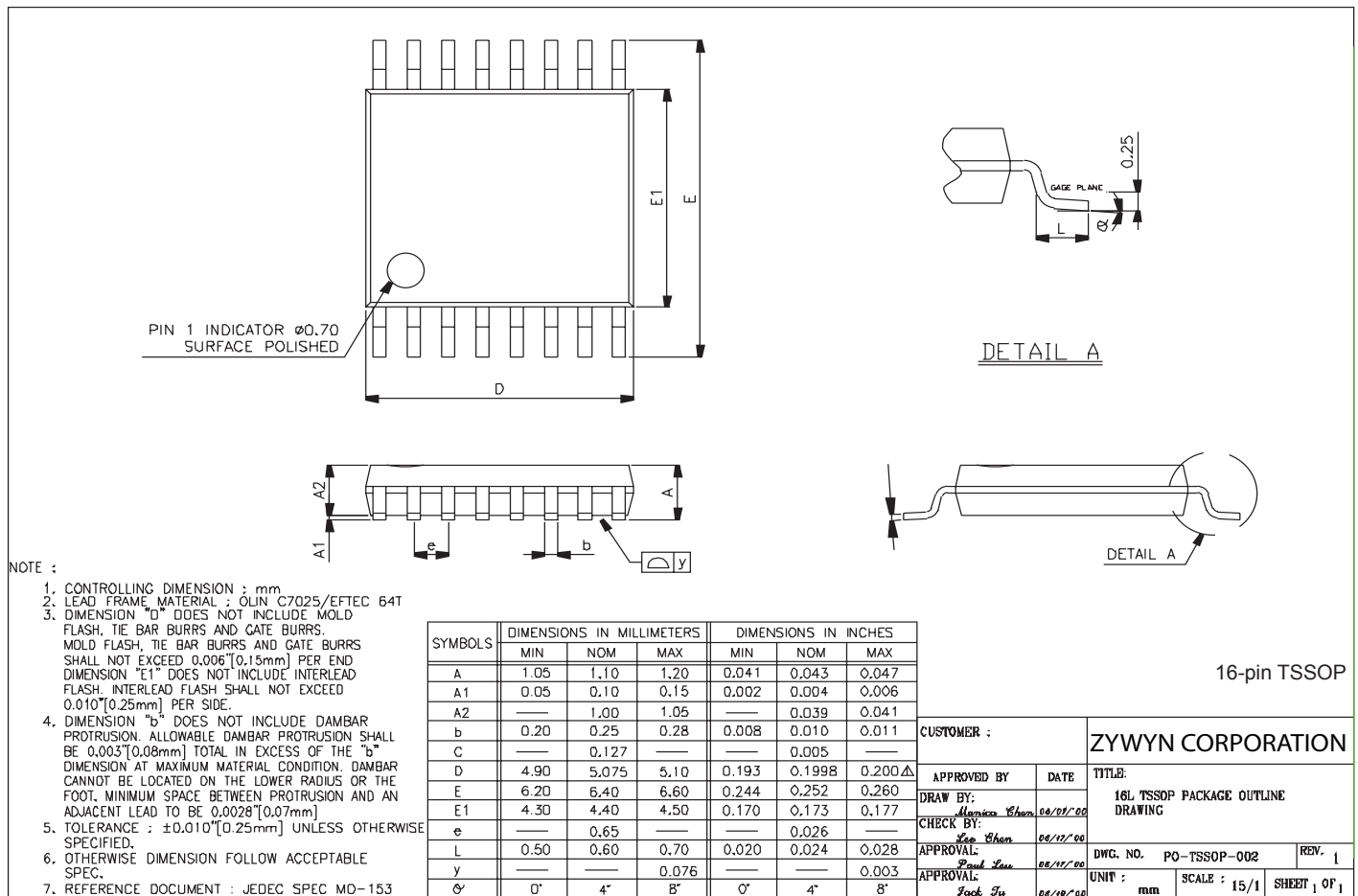
PRR = 250 kbps,  $Z_o = 50\Omega$ , 50% duty cycle,

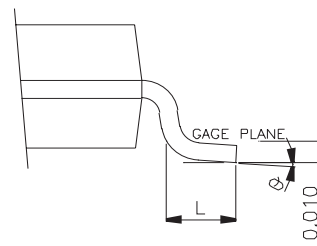
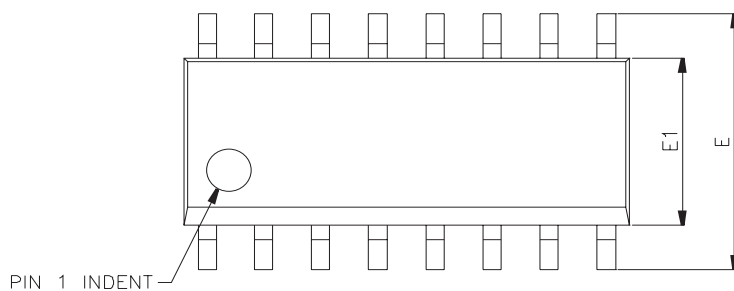
$T_r$  &  $T_f \leq 10ns$ .

C. SHUTDOWN =  $V_{CC}$  when applicable.

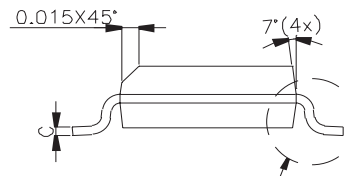
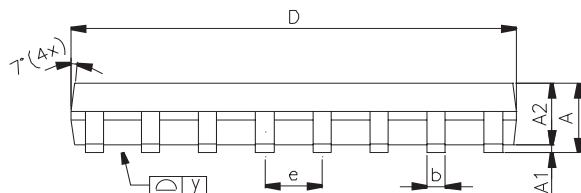
## Package Information







DETAIL A



DETAIL A

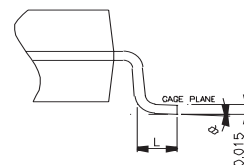
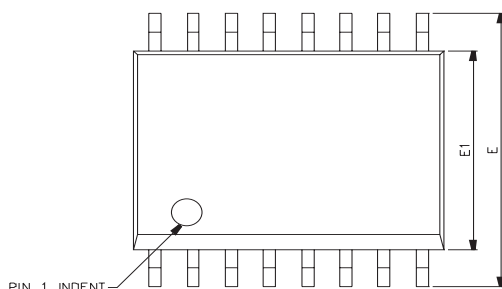
## NOTE :

1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : COPPER 194
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END. DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE :  $\pm 0.010$  "[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT : JEDEC SPEC MS-012

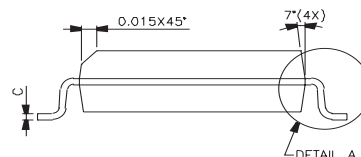
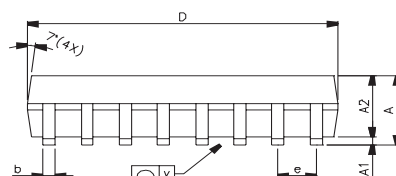
| SYMBOLS | DIMENSIONS IN MILLIMETERS |      |       | DIMENSIONS IN INCHES |       |        |
|---------|---------------------------|------|-------|----------------------|-------|--------|
|         | MIN                       | NOM  | MAX   | MIN                  | NOM   | MAX    |
| A       | 1.47                      | 1.60 | 1.73  | 0.058                | 0.063 | 0.068  |
| A1      | 0.10                      | —    | 0.25  | 0.004                | —     | 0.010  |
| A2      | —                         | 1.45 | —     | —                    | 0.057 | —      |
| b       | 0.33                      | 0.41 | 0.51  | 0.013                | 0.016 | 0.020  |
| C       | 0.19                      | 0.20 | 0.25  | 0.0075               | 0.008 | 0.0098 |
| D       | 9.80                      | 9.91 | 10.01 | 0.386                | 0.390 | 0.394  |
| E       | 5.79                      | 5.99 | 6.20  | 0.228                | 0.236 | 0.244  |
| E1      | 3.81                      | 3.91 | 3.99  | 0.150                | 0.154 | 0.157  |
| e       | —                         | 1.27 | —     | —                    | 0.050 | —      |
| L       | 0.38                      | 0.71 | 1.27  | 0.015                | 0.028 | 0.050  |
| y       | —                         | —    | 0.076 | —                    | —     | 0.003  |
| g       | 0"                        | —    | 8"    | 0"                   | —     | 8"     |

16-pin nSOIC

|                      |          |                                           |                           |
|----------------------|----------|-------------------------------------------|---------------------------|
| CUSTOMER :           |          | ZYWYN CORPORATION                         |                           |
| APPROVED BY          | DATE     | TITLE:                                    |                           |
| DRAW BY: Monica Chen | 11/08/99 | 16L SMALL OUTLINE PACKAGE DRAWING(0.150") |                           |
| CHECK BY: Lee Chen   | 11/10/99 | DWG. NO. PO-SOP-003                       |                           |
| APPROVAL: Paul Lee   | 11/10/99 | REV. 0                                    |                           |
| APPROVAL: Jack Ju    | 11/17/99 | UNIT : INCH                               | SCALE : 12/1 SHEET 1 OF 1 |



DETAIL A



DETAIL A

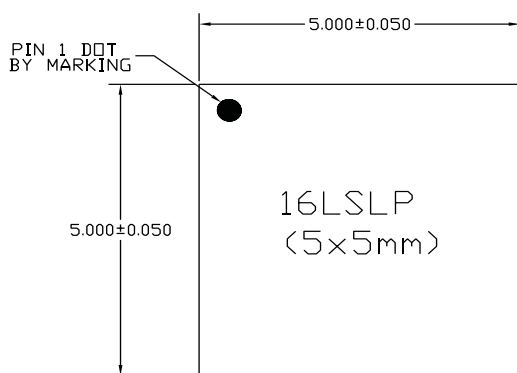
## NOTE :

1. CONTROLLING DIMENSION : INCH
2. LEAD FRAME MATERIAL : COPPER 194
3. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006"[0.15mm] PER END. DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE :  $\pm 0.010$  "[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT : JEDEC SPEC MS-013

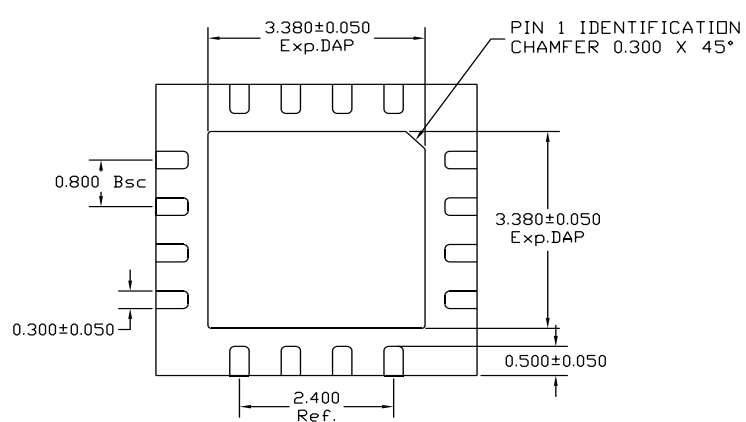
| SYMBOLS | DIMENSIONS IN MILLIMETERS |       |       | DIMENSIONS IN INCHES |       |       |
|---------|---------------------------|-------|-------|----------------------|-------|-------|
|         | MIN                       | NOM   | MAX   | MIN                  | NOM   | MAX   |
| A       | 2.36                      | 2.49  | 2.64  | 0.093                | 0.098 | 0.104 |
| A1      | 0.10                      | —     | 0.30  | 0.004                | —     | 0.012 |
| A2      | —                         | 2.31  | —     | —                    | 0.091 | —     |
| b       | 0.33                      | 0.41  | 0.51  | 0.013                | 0.016 | 0.020 |
| C       | 0.18                      | 0.23  | 0.28  | 0.007                | 0.009 | 0.011 |
| D       | 10.08                     | 10.31 | 10.49 | 0.397                | 0.406 | 0.413 |
| E       | 10.01                     | 10.31 | 10.64 | 0.394                | 0.406 | 0.419 |
| E1      | 7.39                      | 7.49  | 7.59  | 0.291                | 0.295 | 0.299 |
| e       | —                         | 1.27  | —     | —                    | 0.050 | —     |
| L       | 0.38                      | 0.81  | 1.27  | 0.015                | 0.032 | 0.050 |
| y       | —                         | —     | 0.076 | —                    | —     | 0.003 |
| g       | 0"                        | —     | 8"    | 0"                   | —     | 8"    |

16-pin wSOIC

|                      |          |                                             |                          |
|----------------------|----------|---------------------------------------------|--------------------------|
| CUSTOMER :           |          | ZYWYN CORPORATION                           |                          |
| APPROVED BY          | DATE     | TITLE:                                      |                          |
| DRAW BY: Monica Chen | 10/28/99 | 16L WIDE BODY SMALL OUTLINE PACKAGE DRAWING |                          |
| CHECK BY: Lee Chen   | 11/01/99 | DWG. NO. PO-SOP-004                         |                          |
| APPROVAL: Paul Lee   | 11/02/99 | REV. 0                                      |                          |
| APPROVAL: Jack Ju    | 11/08/99 | UNIT : INCH                                 | SCALE : 8/1 SHEET 1 OF 1 |

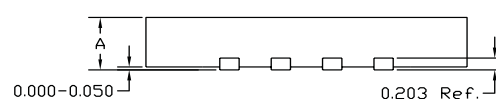


TOP VIEW



BOTTOM VIEW

| A | SLP  |       |
|---|------|-------|
|   | MAX. | 0.900 |
|   | NOM. | 0.850 |
|   | MIN. | 0.800 |

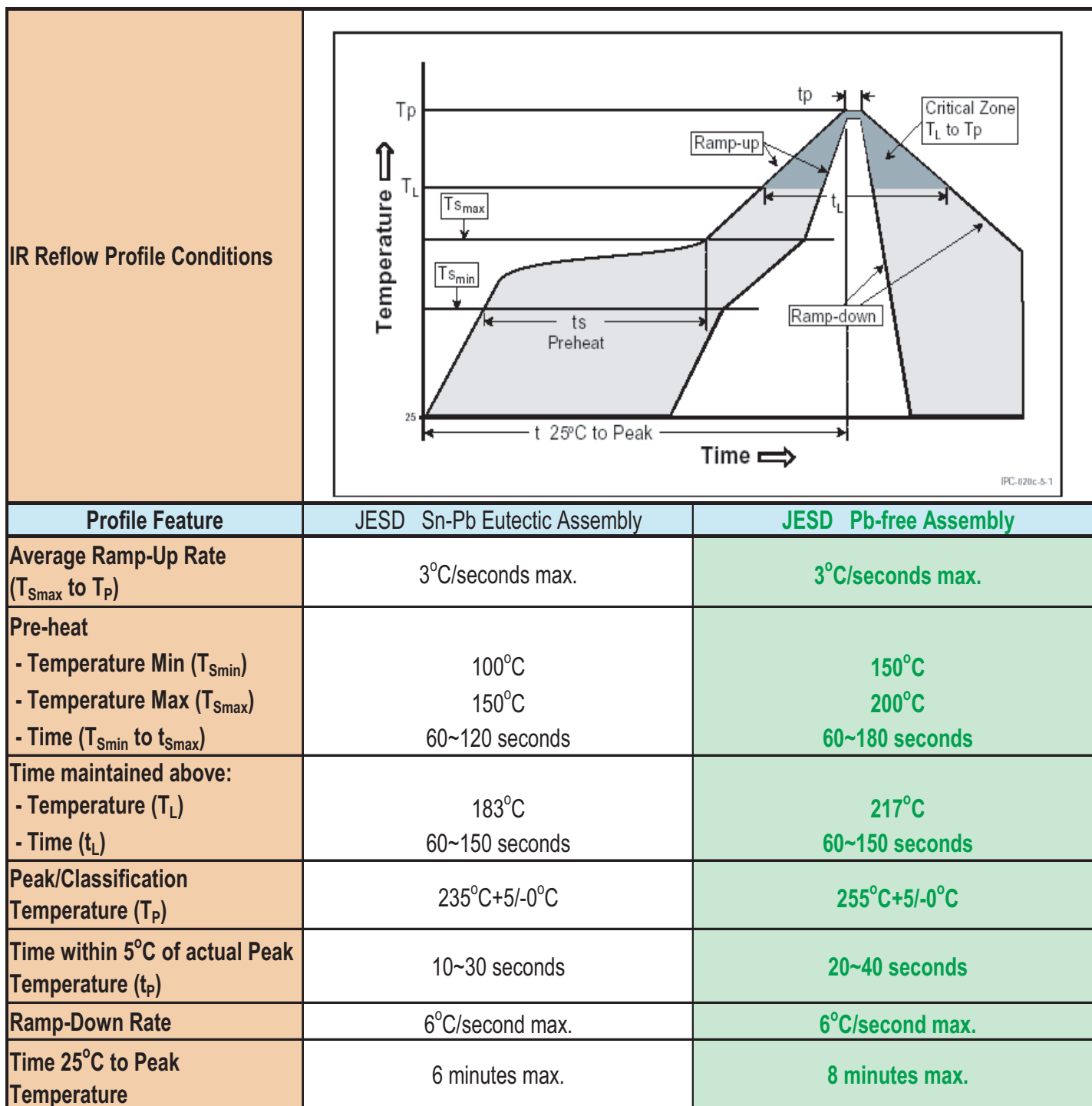


SIDE VIEW

16-Pin 5x5mm QFN  
(5X5 SLP)

|      |             |      |    |      |                                                   |                                                                                                                                     |                                  |          |                                                                                                       |                   |
|------|-------------|------|----|------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------|-------------------------------------------------------------------------------------------------------|-------------------|
|      |             |      |    |      | TOLERANCES<br><br>REFER TO SPECIFICATION<br>ABOVE | UNIT:<br>MM<br><br>SCALE:<br>NTS<br><br>SYMBOL<br> | DESIGNED: BEN ONG                | DATE:    |  ZYWYN CORPORATION |                   |
|      |             |      |    |      |                                                   |                                                                                                                                     | APPD: ANDREW TAN                 | DATE:    |                                                                                                       |                   |
|      |             |      |    |      |                                                   |                                                                                                                                     | APPD: CW CHAI                    | DATE:    |                                                                                                       |                   |
|      |             |      |    |      |                                                   |                                                                                                                                     | APPD: GC TAN                     | DATE:    |                                                                                                       |                   |
|      |             |      |    |      |                                                   |                                                                                                                                     | APPD: YC CHOO                    | DATE:    |                                                                                                       |                   |
| REV. | DESCRIPTION | DATE | BY | APPD |                                                   |                                                                                                                                     | DWG. NO: PO-16(SLP)5x5-3.38x3.38 | REV.: 00 |                                                                                                       |                   |
|      |             |      |    |      |                                                   |                                                                                                                                     |                                  |          | 16L (SLP) 5x5 mm<br>(PACKAGE OUTLINE)                                                                 | SHEET NO : 1 OF 1 |

## Green Package SMD IR Reflow Profile Information



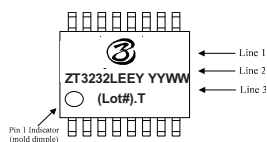
Zywyn Green Packages are Pb-free and RoHS compliance.

## Ordering Information

| Part Number | Temperature Range | Package Type |   |
|-------------|-------------------|--------------|---|
| ZT3220LEEA  | -40°C to +85°C    | 16-pin SSOP  | ▲ |
| ZT3220LEET  | -40°C to +85°C    | 16-pin WSOIC | ▲ |
| ZT3220LEEY  | -40°C to +85°C    | 16-pin TSSOP | ▲ |
| ZT3221LEEA  | -40°C to +85°C    | 16-pin SSOP  | ▲ |
| ZT3221LEEY  | -40°C to +85°C    | 16-pin TSSOP | ▲ |
| ZT3222LEEA  | -40°C to +85°C    | 20-pin SSOP  | ▲ |
| ZT3222LEET  | -40°C to +85°C    | 18-pin WSOIC | ▲ |
| ZT3222LEEY  | -40°C to +85°C    | 20-pin TSSOP | ▲ |
| ZT3223LEEA  | -40°C to +85°C    | 20-pin SSOP  | ▲ |
| ZT3223LEEY  | -40°C to +85°C    | 20-pin TSSOP | ▲ |
| ZT3232LEEA  | -40°C to +85°C    | 16-pin SSOP  | ▲ |
| ZT3232LEEN  | -40°C to +85°C    | 16-pin nSOIC | ▲ |
| ZT3232LEET  | -40°C to +85°C    | 16-pin WSOIC | ▲ |
| ZT3232LEEY  | -40°C to +85°C    | 16-pin TSSOP | ▲ |
| ZT3232LEEQ  | -40°C to +85°C    | 16-pin QFN   | ▲ |
| ZT1385LEEA  | -40°C to +85°C    | 20-pin SSOP  | ▲ |
| ZT1385LEET  | -40°C to +85°C    | 18-pin WSOIC | ▲ |

Please contact the factory for pricing and availability on Tape-and-Reel options.

### TOPSIDE MARK INSTRUCTIONS:



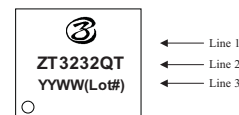
Line 1: Zywyn (logo)  
 Line 2: Zywyn Part Number "ZT3232LEEY", Space " ", Date Code (Prod Year & Week)  
 Line 3: Lot #, dot and Country ".T"  
 Note: Pin # 1 "▲" Indicator Required if no mold dimple

### BOTTOMSIDE MARK INSTRUCTIONS:



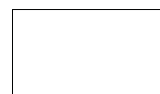
No backside marking

### TOPSIDE MARK INSTRUCTIONS:



Line 1: Zywyn (logo)  
 Line 2: Zywyn Part Number "ZT3232QT", Country "T"  
 Line 3: Date Code (Prod Year & Week), Lot # (last 4 characters from the right after the dot, but exclude the dot)  
 Note: Pin # 1 "▲" Indicator Required if no mold dimple

### BOTTOMSIDE MARK INSTRUCTIONS:



No backside marking

## Zywyn Corporation

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